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TRANS WORLD TIDAL GRAVITY PROFILE.(U)
DEC 76 P MELCHIOR

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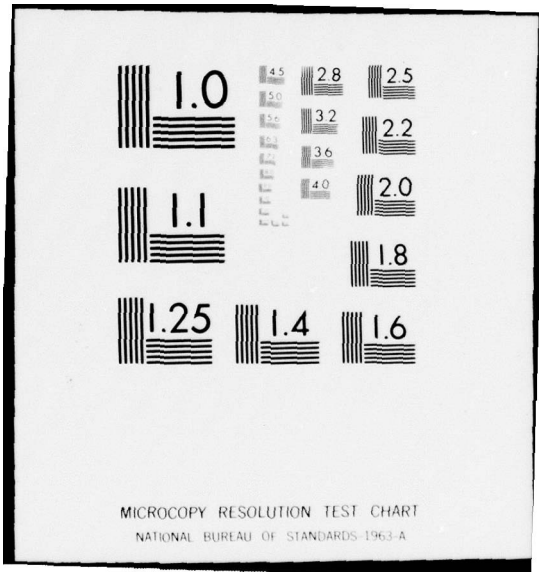
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NATIONAL BUREAU OF STANDARDS-1963-A

AFGL-TR-77-0037

TRANS WORLD TIDAL GRAVITY PROFILE

P. Melchior

Royal Observatory of Belgium
Avenue Circulaire, 3
B-1180 Brussels, Belgium

Scientific Report No. 3

December 1976

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AIR FORCE GEOPHYSICS LABORATORY
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
HANSCOM AFB, MASSACHUSETTS 01731

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GRAVIMETRY EARTH TIDES

20. Abstract

Tidal gravity profiles were established in Australia and Papua, New Guinea, commencing September 1974. Five stations were occupied in all using four tidal gravimeters. Data were analyzed at the International Center for Earth Tides, Brussels, and the results obtained are presented. The gravimeters were calibrated at the fundamental station established at Canberra. Uniformity is maintained with the Brussels fundamental station. It is assessed that the normalization coefficients for each instrument are correct to about 0.5% for the diurnal waves and about 1% for M_2.

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FORM 1473

CONSEIL INTERNATIONAL DES UNIONS SCIENTIFIQUES
FEDERATION DES SERVICES PERMANENTS D'ASTRONOMIE ET DE GEOPHYSIQUE (FAGS)

CENTRE INTERNATIONAL DES MAREES TERRESTRES

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Trans World Tidal Gravity Profile

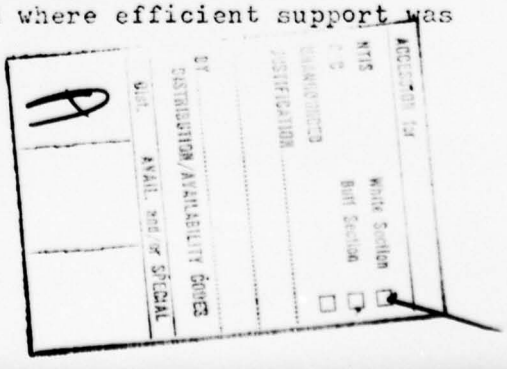
Grant AFOSR 73-2557 Interim Scientific Report n° 3

Period 1973 june 01 - 1976 september 30

This operation is conducted by the International Center for Earth Tides (ICET) with the support of the Department I (Fundamental Astronomy and Geodynamics) of the Royal Observatory of Belgium (ORB).

The program, the equipments used for it and the method of analysis of the data are described in the previous interim scientific reports n° 1 and n° 2 and will not be reproduced here.

Changes in the initial program of installation of stations had to be made to take profit of new informations and to spare travel expenses when possible. The main changes were the provisional abandon of the measurements planned in India where we encountered some difficulties and an extension of measurements in Australia, Indonesia, New Zealand where efficient support was provided to our project.



It must be emphasized indeed that our project raised considerable interest in most of the countries. Efficient support was provided in Thailand and Malaysia for the transportation of the equipments and the preparation of suitable sites. Similar support was given in Australia, Indonesia and New Zealand but some financial support was also obtained there to cover part or total of the travel expenses inside the concerned country.

This has permitted to establish more stations than initially planned : 8 in Australia, 2 in New Zealand and up to 3 or 4 in Indonesia if the program is continued until 1978.

New stations established in 1976

The stations at Penang, Bandung, Noumea and Lauder have been described in previous reports as well as Canberra and Alice Springs still operating in 1976. Four new stations are described here :

Kuala Lumpur (Malaysia)

The gravimeter Geodynamics 765 was transferred from Penang to Kuala Lumpur by P. Melchior on november 8. The instrument is installed in the basement of the Department of Geology of the University of Malaysia.

After some readjustment between inner and outer thermostats it gave a very nice tidal curve.

The station was revisited on november 26 when returning from Indonesia and an excellent two weeks curve was brought back to Bruxelles.

Macassar/Ujung Pandang (Celebes - Indonesia)

The gravimeter La Coste Romberg 336 was transferred from Bandung to Macassar by P. Melchior on november 18. It had been used on november 16-17 to realize precise gravimetric ties between Bandung and Jakarta.

The installation at Macassar, in the Gowa Seismological station was quite easy despite the high temperature in this area.

A beautiful tidal curve was obtained from the third day of installation. It is to be noted that due to some electronic troubles the recorder used at Bandung had to be replaced by a new one brought from Bruxelles by Melchior.

Suva (Fiji)

The gravimeter La Coste Romberg 402 was transferred from Noumea to Suva by B. Ducarme on november 14. Also here the recorder had to be replaced by a new one that Ducarme brought with him.

This installation has been really difficult because of strike in Fiji Airlines but Ducarme succeeded to establish a good station within two days only.

The equipment is installed in the Vunikawai radio station (formerly a provisional seismic station) depending from Post and Telegraph of Fiji.

Hamilton (New Zealand, Northern Island)

Much help was provided by W. Reilly, Director of the Geophysical Department of New Zealand (DSIR). The equipment indeed was disconnected at Lauder and transferred to Hamilton by him so that B. Ducarme could instal it within a few days. The tidal curve just received at Bruxelles is of exceptional quality.

The station is installed in the basement of the building C in the room of mass spectrometer of the Faculty of Sciences of Waikato University.

Technical descriptions of these stations are given in Annex 2.

Calculations of the loading effects for all the station

Dr Henderschott very kindly sent us on a magnetic tape a digitized version of his cotidal map as well as another still unpublished version of it by M.E. Parke.

My assistant, M. Moens, has spent much of his time with the calculation of the indirect effects on the basis of Farrell's procedure, using the Zahel, Bogdanov, Hendershott and Parke maps.

For each station the influence of the different oceans was calculated separately with the aim to find which zone has the determining influence at each place.

Conclusions of this investigation should be available before 3 months.

The future of the project

The obtained results are very encouraging.

One can emphasize the consistency of the phases obtained in New Zealand and New Caledonia with those obtained along the east coast of Australia.

Five different instruments have been used in the six stations concerned (Charters Towers, Armidale, Canberra, Hobart, Lauder, Noumea) and, as shown on the map n° 1, give consistent results for the diurnal waves (K_1, O_1) as well as for the semi-diurnal wave M_2.

The same remark is to be made concerning our results in the South China Sea and the Gulf of Thailand (map n° 2) where our stations Hong Kong, Manila, Bangkok and Penang can be compared with the results obtained previously by UCLA at Baguio and Saigon. The station planned at Kota Kinabalu will be extremely interesting in this respect.

It is my feeling that the phases provide a very important constraint for the oceanic cotidal charts and therefore can be used efficiently to improve these maps.

Anyway the results until now obtained demonstrate a clear regional trend which is very different of this one observed in Europe by Melchior, Kuo and Ducarme (1976).

A densification of the network of stations in the other areas is needed and will surely help to understand the mechanism of this "regionality" and provide data for a correct computation of the periodic deformations in large areas of the Earth's surface.

I therefore plan to later install the equipments possibly in Colombo (Sri Lanka), Iran, Afghanistan, Irak, Saudi Arabia, Kuwait and Turquey when returning them towards Europe at the end of 1977.

However I presently try to maintain the five equipments in the remote area where they are, for two reasons :

Firstly it should be extremely expensive if we had to return there later on to add some needed station in the net. We must do the maximum we can now.

Secondly, I have some hope that in the course of 1977 I could be in a position to introduce a proposition to Academia Sinica to establish one or more stations in continental China. It is therefore convenient to keep the equipments not far from Hong Kong.

It is my intention to present for publication all the results now available within three months or so.

Annexes

1 - Time Table and Map of the profile in Asia and Pacific area

2 - Technical description of the four stations established in november 1976

3 - Detailed results of the analysis of the new data obtained at Penang, Bandung, Lauder, Noumea.
(Definitive results in Australia are given in Annex 5).

4 - Summary of all results so far obtained in the 21 stations where the measurements are completed.

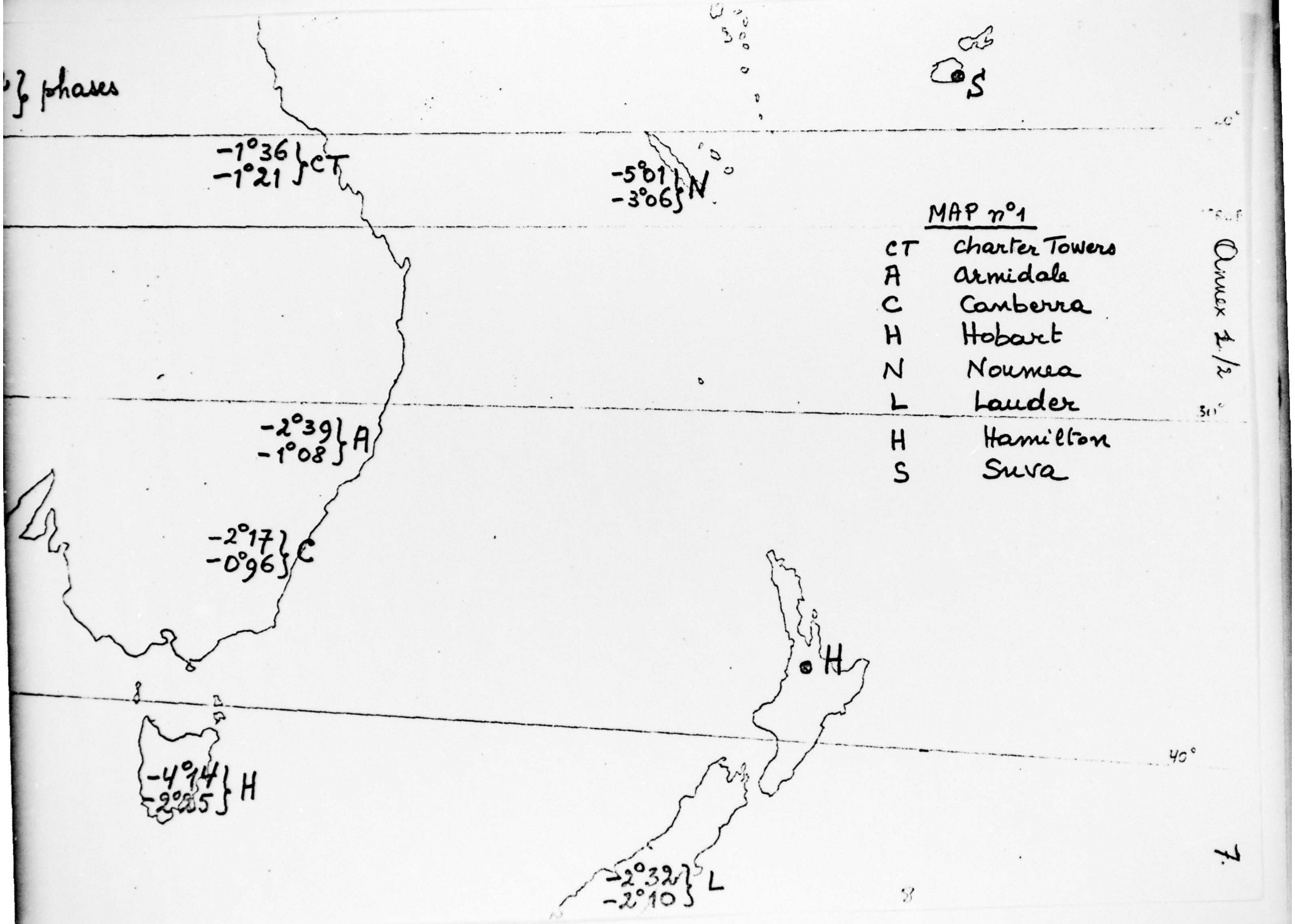
5 - Preprint of a paper under publication which presents a discussion of the results of measurements in Australia and Papua New Guinea.

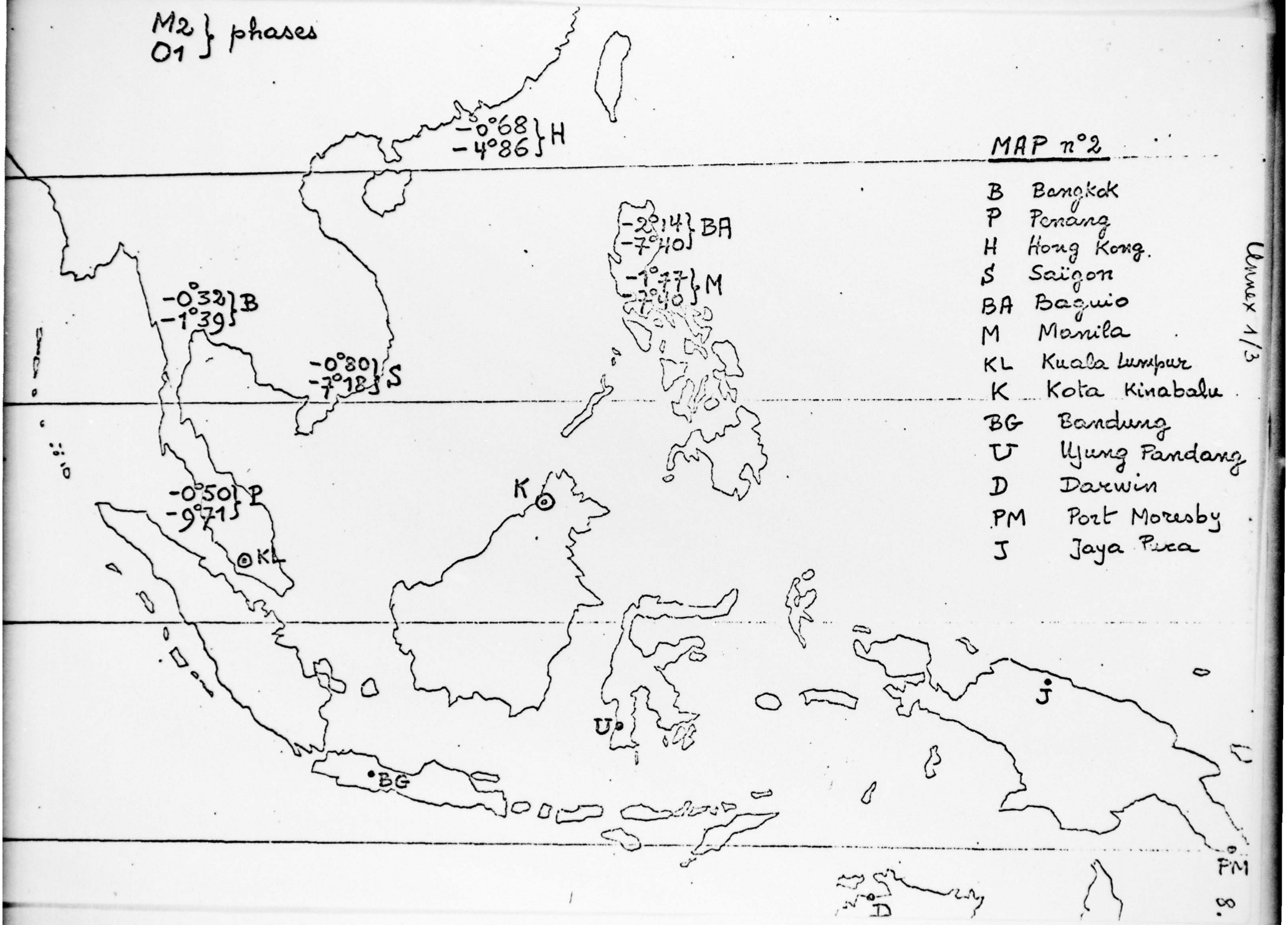
Annex 1/1

TRANS WORLD TIDAL GRAVITY PROFILE ASIA - PACIFIC

14/12/76 D NUMBER OF DAYS ANALYSED

INSTR.		STATION		EPOCH	D
G 084		0201	BRUXELLES	71 06 29 - 73 11 08	782
G 084		2501	BANGKOK	73 11 17 - 74 03 13	96
G 084		2502	CHIANG MAI	74 04 09 - 74 09 08	132
G 084		2450	KATHMANDU	74 09 30 - 75 03 14	80
G 084		4206	CANBERRA	75 04 04 - 75 07 03	86
G 084		4205	ARMIDALE	75 07 17 - 76 01 24	160
G 084	*	4209	ALICE SPRINGS	76 02 11 - 77 04	114
G 765		0201	BRUXELLES	75 09 14 - 76 03 27	170
G 765		2551	PENANG	76 04 04 - 76 11 07	164
G 765	*	2550	KUALA LUMPUR	76 11 11 -	
G 765		2555	KOTA KINABALU	77 04	
G 765			RIYADH		
G 765			BAGHDAD		
G 804		0201	BRUXELLES	73 08 02 - 73 11 10	94
G 804		2402	HYDERABAD	73 12 11 - 74 08 29	180
G 804		2401	DELHI	74 10 17 - 75 05	80
G 804		6405	NEW YORK	75 05 -	
G 804		0201	BRUXELLES	77	
L 003		0201	BRUXELLES	73 08 14 - 73 11 06	78
L 003		4011	MANILA	73 11 22 - 74 04 15	86
L 003		2601	HONG KONG	74 04 20 - 74 09 09	110
L 003		4160	PORT MORESBY	74 09 22 - 75 03 13	146
L 003		4206	CANBERRA	75 03 31 - 75 06 27	78
L 003		4208	BROKEN HILL	75 07 09 - 75 12 07	106
L 003		4207	CHARTERS TOWERS	75 12 14 - 76 05 10	92
L 003		4206	CANBERRA	76 05 21 - 76 11	82
L 003	*	0201	BRUXELLES	76 11 30 -	
L 008		4206	CANBERRA	75 07 22 - 75 11 02	94
L 008		4220	HOBART	75 11 11 - 76 04 30	130
L 008		4420	LAUDER NZ/S	76 05 30 - 76 11	82
L 008	*	4400	HAMILTON NZ/N	76 11 21 -	
L 336		0201	BRUXELLES	73 11 09 - 74 08 01	144
L 336		0315	SEVRES BPM	74 08 03 - 74 09 06	28
L 336		3000	CAIRO/HELWAN	74 09 26 - 75 03 04	72
L 336		4206	CANBERRA	75 03 30 - 75 06 27	88
L 336		4211	PERTH/MUNDARING	75 07 11 - 75 11 10	98
L 336		4210	DARWIN	75 12 12 - 76 04 05	88
L 336		4100	BANDUNG	76 04 12 - 76 11 15	126
L 336	*	4110	MACASSAR	76 11 20 - 77 04	
L 336		4150	JAYA PURA	77 04	
L 402		0201	BRUXELLES	76 03 05 - 76 05 15	60
L 402		4450	NOUMEA	76 06 22 - 76 11 08	80
L 402	*	4470	SUVA FIJI	76 11 17 -	


} phases
-1°36 } CT
-1°21 }
-5°01 } N
-3°06 }
S
MAP n°1
CT Charter Towers
A Armidale
C Canberra
H Hobart
N Noumea
L Lauder
H Hamilton
S Suva
-2°39 } A
-1°08 }
-2°17 } C
-0°96 }
H
-4°14 } H
-2°35 }
-2°32 } L
-2°10 }
Annex I./2
7.



MAP n°2

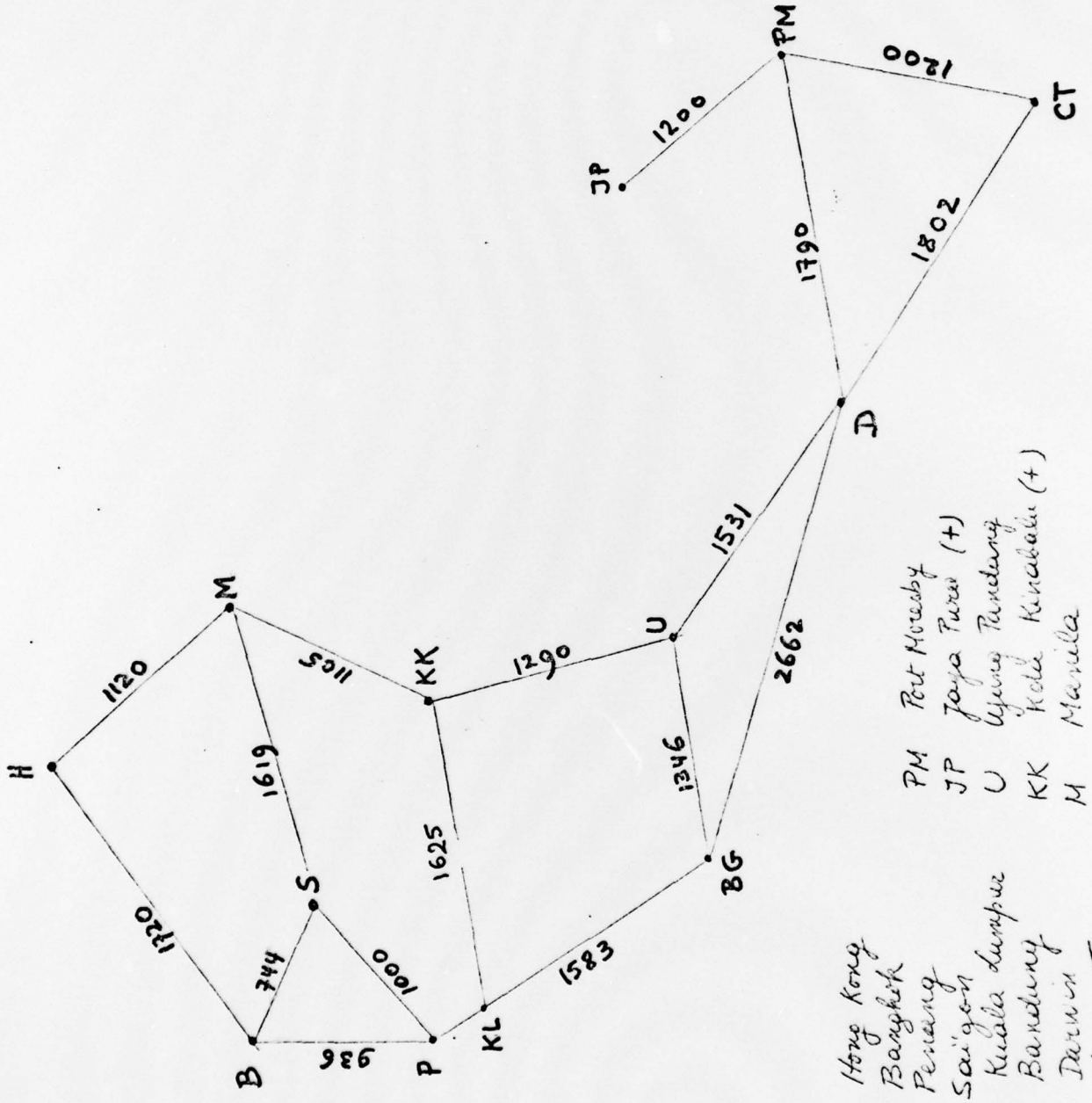
B Bangkok
P Penang
H Hong Kong
S Saigon
BA Baguio
M Manila
KL Kuala Lumpur
K Kota Kinabalu
BG Bandung
U Ujung Pandang
D Darwin
PM Port Moresby
J Jaya Pura

Annex 1/3

Annex 1/4

South East Asia and Northern Australia net

Distances given in kilometers



H Hong Kong
B Bangkok
P Penang
S Saigon
KL Kuala Lumpur
BG Bandarung
D Darwin
CT Charter Towers

PM Port Moresby
JP Jaya Pura (+)
U Ujung Pandang
KK Kota Kinabalu (+)
M Manila

(+) Stations on project for 1977

```
 7652550
00 -101.654     3.122      0.032     978.0      0.66   1.40664      0.81
TRANS WORLD PROFILE          MALAYSIA            STATION KUALA LUMPUR          11
STATION 2550 KUALA LUMPUR       VERTICAL COMPONENT        SELANGOR-MALAYSIA
 3 07 N      101 39E              H   32 M                      D   30KM        1
UNIVERSITI MALAYA, DEPARTMENT OF GEOLOGY   PROF.N.S.HAILE
BUILDING ON SEDIMENTARY ROCKS / ARGILLITE AND SANDSTONE /                      1
OF THE KENNY HILL FORMATION, PROBABLY TRIASSIC OR PERMIAN                      1
GRAVIMETRE GEODYNAMICS 765  P.MELCHIOR   TRANS WORLD PROFILES
CALIBRATION                  BRUXELLES - FUNDAMENTAL STATION
INSTALLATION                 P.MELCHIOR
MAINTENANCE                  S.C.CHAN / C.T.TAN
GRANT AFOSR-73-2557 A  PROJECT-TASK 8607-02
99
GRAV       GEO 765
9999
 3364110
00 -119.6333   -5.6666     0.028     978.0      1.24   1.00587      1.21
TRANS WORLD PROFILE            INDONESIA          STATION UJUNG PANDANG    11
STATION 4110 UJUNG PANDANG      VERTICAL COMPONENT        SULAWESI-INDONESIA
 5  4 S      119 38 E            H   28 M       P  0 M          D  12KM
STASIUN GEOFISIKA GOWA/ PUSAT METEOROLOGI DAN GEOFISIKA, UJUNG PANDANG         1
UJUNG PANDANG IS MAKASSAR IN SULAWESI/CELEBES/
IUGG NATIONAL COMMITTEE,   J.RAIS
GRAVIMETER LACOSTE-ROMBERG 336 P.MELCHIOR    TRANS WORLD PROFILES
CALIBRATION                  CANBERRA-FUNDAMENTAL STATION
INSTALLATION                 P.MELCHIOR/Y.S.JOYODIWIRYO
MAINTENANCE                  KADENAN
GRANT AFOSR-73-2557 A  PROJECT-TASK 8607-02
99
GRAV       LCR 336

   84400
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TRANS WORLD PROFILE            NEW ZEALAND              STATION HAMILTON 11
STATION 4400 HAMILTON           VERTICAL COMPONENT          NEW ZEALAND
37 47 S      175 19 E            H  30 M        P             D  40KM
WAIKATO UNIVERSITY     SCHOOL OF SCIENCE     J.D.MC CRAW
DEPT OF SCIENTIFIC AND INDUS.RES., GEOPHYSICAL DIVISION     W.I.REILLY
GRAVIMETER LACOSTE-ROMBERG 008 P.MELCHIOR   TRANS WORLD PROFILES
CALIBRATION                  CANBERRA-FUNDAMENTAL STATION
INSTALLATION                 B.DUCARME
MAINTENANCE                  A.PEPPER/R.HOLDSWORTH
GRANT AFOSR-73-2557 A  PROJECT-TASK 8607-02
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GRAV       LCR 008

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STATION 4460 SUVA - VUNIKAWAI   VERTICAL COMPONENT          VITI LEVU - FIJI
MINERAL RESOURCES DIVISION   R.N.RICHMOND                                      1
18 03 S      178 28 E            H 160 M        P             D  15KM
GRAVIMETER LACOSTE-ROMBERG 402 P.MELCHIOR   TRANS WORLD PROFILES
CALIBRATION                  BRUXELLES - FUNDAMENTAL STATION
INSTALLATION                 B.DUCARME
MAINTENANCE                  K.DRAUNIDALO
GRANT AFOSR-73-2557 A  PROJECT-TASK 8607-02
99
GRAV       LCR 402
```

TRANS WORLD PROFILE MALAYSIA STATION PENANG

STATION 2551 PENANG VERTICAL COMPONENT MALAYSIA
5 21 N 100 18 E H 12 M P 10 M D 1.2 KM
UNIVERSITI SAINS MALAYSIA PROF. CHATAR SINGH
BUNKER NEAR THE EAST COAST OF PENANG ISLAND
GRAVITIC INTRUSIVE ABOUT 15 KM BY 22 KM, SEPARATED FROM THE MAINLAND ABOUT 3KM
GRAVIMETER GEODYNAMICS 765 P.MELCHIOR TRANS WORLD PROFILES
CALIBRATION BRUXELLES-FUNDAMENTAL STATION
INSTALLATION B.DUCARME
MAINTENANCE PH. MARTIN/P.RYALL/C.L.SAMZ
GRANT AFOSR-73-2557A PROJECT-TASK 8607-02
METHODE DES MOINDRES CARRES / FILTRES VENEDIKOV / LECTURES HORAIRES
POTENTIEL CARTWRIGHT TAYLER EDDEN / DEVELOPPEMENT COMPLET
CORRECTION D INERTIE PROPORTIONNELLE AU CARRE DES VITESSES
CALCUL CENTRE INTERNATIONAL DES MAREES TERRESTRES /FAGS/ BRUXELLES

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GEO	765	76	6	22	76	7	4	76	7	7	76	7	9	76	7	13	76	8	4
GEO	765	76	8	10	76	8	14	76	8	18	76	8	28	76	9	5	76	9	7
GEO	765	76	9	11	76	9	15	76	9	19	76	9	25	76	9	29	76	10	3
GEO	765	76	10	9	76	10	27												

NOMBRE TOTAL DE JOURS 164 3936 LECTURES

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		EPOQUE CENTRALE						
1- 62	Q1	1.1624	-1.56	1.3120	0.1366	-3.12	5.95	1.3919
63- 88	O1	5.7361	128.33	1.1546	0.0296	-9.71	1.46	5.6338
89-110	M1	0.7602	92.47	1.1866	0.2081	15.79	10.05	0.8109
111-120	P1	2.8961	254.57	1.1329	0.0545	-2.46	2.75	2.9728
121-143	S1K1	7.5703	302.73	1.0501	0.0194	-7.44	1.06	7.7247
144-165	J1	0.4175	70.86	0.9346	0.2781	-7.06	17.00	0.4797
166-197	OO1	0.1202	335.84	1.1473	0.8509	11.84	42.41	0.1900

ERREUR Q.M. D 5.636430

GROUPE	SYMBOLE	AMPLITUDE	PHASE	FACT.AMPL.	EQM	DEPHASAGE	EQM	AMPLITUDE MOYENNE
		EPOQUE CENTRALE						
198-236	2N2	0.4616	77.67	1.1432	0.0446	-3.59	2.24	3.1445
237-260	N2	13.3971	132.38	1.1253	0.0091	0.53	0.47	16.5487
261-286	M2	86.6660	270.80	1.1293	0.0017	-0.45	0.09	86.4455
287-300	L2	1.6914	214.21	0.9916	0.0569	1.80	3.30	2.2260
301-309	S2	36.9697	21.65	1.1329	0.0038	0.56	0.20	37.9427
310-347	K2	7.9225	264.67	1.1372	0.0175	-0.02	0.89	8.4129

ERREUR Q.M. SD 5.125764

O1/K1 1.0996 1-O1/1-K1 3.0867 M2/O1 0.9781

348-363	M3	1.5537	124.08	1.0687	0.0177	-1.55	0.95	1.6832

ERREUR Q.M. TD 1.052038
EPOQUE DE REFERENCE TJJ# 42976.0

TRANS WORLD PROFILE INDONESIA STATION BANDUNG

STATION 4100 BANDUNG VERTICAL COMPONENT JAVA - INDONESIA
6 54 S 107 38 E H 714 D 70KM
INSTITUTE OF TECHNOLOGY BANDUNG PROF.J.RAIS
UNDERLAYER OF VERY THICK VOLCANIC DEPOSIT OF SAND & OTHER VOLC.PRODUCTS
GRAVIMETER LACOSTE-ROMBERG 336 P.MELCHIOR TRANS WORLD PROFILES
CALIBRATION BRUXELLES-FUNDAMENTAL STATION
INSTALLATION B.DUCARME
MAINTENANCE M.UNTUNG/Y.JOYODIWIRYO
GRANT AFOSR-73-2557A PROJECT-TASK 8607-02
METHODE DES MOINDRES CARRES / FILTRES VENEDIKOV / LECTURES HORAIRES
POTENTIEL CARTWRIGHT TAYLER EDDEN / DEVELOPPEMENT COMPLET
CORRECTION D INERTIE PROPORTIONNELLE AU CARRE DES VITESSES
CALCUL CENTRE INTERNATIONAL DES MAREES TERRESTRES /FAGS/ BRUXELLES

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CORRECTION D ATTENUATION DIFFERENTIELLE M2/O1 1.01611 /MODELE 2/

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LCR	336	76	5	12	76	5	20	76	5	22	76	5	22	76	5	25	76	6	4
LCR	336	76	6	8	76	6	18	76	6	22	76	6	24	76	6	27	76	6	29
LCR	336	76	7	2	76	7	4	76	7	7	76	8	28						

NOMBRE TOTAL DE JOURS 126 3024 LECTURES

GROUPE	SYMBOLE	AMPLITUDE	PHASE	FACT.AMPL.	EQM	DEPHASAGE	EQM	AMPLITUDE MOYENNE
		EPOQUE CENTRALE						
1- 62	Q1	1.5799	151.77	1.4936	0.2572	12.42	9.82	1.6945
63- 88	O1	7.6735	297.82	1.1669	0.0450	9.50	2.21	7.5674
89-110	M1	0.9954	360.83	1.0169	0.2853	5.35	16.08	1.0250
111-120	P1	5.2217	134.14	1.5888	0.0901	24.86	3.27	5.2859
121-143	S1K1	10.8049	120.95	1.1641	0.0315	8.54	1.56	10.9558
144-165	J1	0.5117	266.59	1.3550	0.6873	-2.64	29.08	0.5597
166-197	OO1	0.1576	132.52	1.1368	1.3560	4.38	68.63	0.2387

ERREUR Q.M. D 10.003016

GROUPE	SYMBOLE	AMPLITUDE	PHASE	FACT.AMPL.	EQM	DEPHASAGE	EQM	AMPLITUDE MOYENNE
		EPOQUE CENTRALE						
198-236	2N2	2.0387	353.07	1.1329	0.0942	5.36	4.91	2.5343
237-260	N2	16.5253	85.82	1.2358	0.0172	-1.04	0.80	17.3897
261-286	M2	95.2520	223.20	1.2508	0.0031	-1.37	0.14	95.2440
287-300	L2	2.6270	164.18	1.5162	0.1247	-5.87	4.80	2.7741
301-309	S2	39.2227	37.95	1.2108	0.0073	3.59	0.36	39.7978
310-347	K2	7.8797	223.52	1.1574	0.0331	-2.43	1.66	8.3541

ERREUR Q.M. SD 8.090041

O1/K1 1.0024 1-O1/1-K1 1.0170 M2/O1 1.0719
EPOQUE DE REFERENCE TJJ# 42949.0

TRANS WORLD PROFILE NEW ZEALAND STATION LAUDER

STATION 4420 LAUDER VERTICAL COMPONENT NEW ZEALAND
STATION AURORAL J.G.KEYS
45 02 S 169 41 E H 364 M P 1 M D 100KM
GRAVIMETRE LACOSTE-ROMBERG 008 P.MELCHIOR TRANS WORLD PROFILES
CALIBRATION CANBERRA - FUNDAMENTAL STATION
INSTALLATION M.VAN RUYMBEKE
MAINTENANCE P.JOHNSTON/D.ROWLES
GRANT AFOSR-73-2557 A PROJECT-TASK 8607-02
METHODE DES MOINDRES CARRES / FILTRES VENEDIKOV / LECTURES HORAIRES
POTENTIEL CARTWRIGHT TAYLER EDDEN / DEVELOPPEMENT COMPLET
CORRECTION D INERTIE PROPORTIONNELLE AU CARRE DES VITESSES
CALCUL CENTRE INTERNATIONAL DES MAREES TERRESTRES /FAGS/ BRUXELLES

FACTEUR D ECHELLE 1.00059
IRAINAGE O1 0.91 M2 1.44 O1/M2 0.63
RETARD INSTRUMENTAL 513.90 MIN.
CORRECTION D ATTENUATION DIFFERENTIELLE M2/O1 1.01181 /MODELE 2/

LCR	008	76	5	31	76	6	4	76	6	17	76	6	17	76	6	29	76	7	3
LCR	008	76	7	7	76	7	7	76	7	11	76	7	17	76	7	25	76	7	29
LCR	008	76	8	4	76	9	11	76	9	13	76	10	9	76	10	13	76	11	2
LCR	008	76	11	5	76	11	7												

NOMBRE TOTAL DE JOURS 124 2976 LECTURES

GROUPE	SYMBOLE	AMPLITUDE	PHASE EPOQUE CENTRALE	FACT.AMPL.	EQM	DEPHASAGE	EQM	AMPLITUDE MOYENNE
1- 62	O1	5.8717	14.07	1.2481	0.0525	-4.38	2.41	6.4172
63- 88	O1	32.6073	242.90	1.2351	0.0103	-1.54	0.48	32.5287
89-110	M1	2.9058	328.81	1.3390	0.1175	0.35	5.03	3.0056
111-120	P1	18.5111	110.40	1.3215	0.0193	-4.06	0.84	18.8619
121-143	S1K1	45.6982	229.94	1.1551	0.0071	-2.79	0.35	45.8545
144-165	J1	2.7393	113.89	1.3834	0.1189	7.38	4.90	3.0794
166-197	OO1	1.1832	34.44	1.2591	0.2766	-9.23	12.61	1.2068

ERREUR Q.M. D 9.115340

GROUPE	SYMBOLE	AMPLITUDE	PHASE EPOQUE CENTRALE	FACT.AMPL.	EQM	DEPHASAGE	EQM	AMPLITUDE MOYENNE
198-236	2N2	0.8383	146.04	1.0608	0.1791	-8.74	9.75	1.4487
237-260	N2	8.2458	66.74	1.2020	0.0348	-3.20	1.67	9.2748
261-286	M2	45.8101	298.61	1.1810	0.0069	-1.85	0.34	45.7246
287-300	L2	0.6261	-11.72	0.9288	0.3226	-37.45	20.08	0.7257
301-309	S2	18.4582	160.20	1.1024	0.0160	-1.36	0.84	18.7836
310-347	K2	4.3632	107.78	1.2352	0.0732	2.07	3.43	4.6434

ERREUR Q.M. SD 8.978478

O1/K1 1.0692 1-O1/1-K1 1.5153 M2/O1 0.9562

348-363	M3	0.4674	189.50	1.0761	0.1047	-7.81	5.69	0.6081

ERREUR Q.M. TD 1.944239
EPOQUE DE REFERENCE TJJ# 43010.0

TRANS WORLD PROFILE NOUVELLE CALEDONIE STATION NOUMEA

STATION 4450 NOUMEA VERTICAL COMPONENT NOUVELLE CALEDONIE
O.R.S.T.O.M. J.DUBOIS
22 19 S 166 27 E H 130 M P 2 M D 1 KM
GRAVIMETRE LACOSTE-ROMBERG 402 P. MELCHIOR TRANS WORLD PROFILES
CALIBRATION BRUXELLES - FUNDAMENTAL STATION
INSTALLATION M.VAN RUYMBEKE
MAINTENANCE F.MISSEGUE/R.LOUAT
GRANT AFOSR-73-2557 A PROJECT-TASK 8607-02
METHODE DES MOINDRES CARRES / FILTRES VENEDIKOV / LECTURES HORAIRES
POTENTIEL CARTWRIGHT TAYLER EDDEN / DEVELOPPEMENT COMPLET
CORRECTION D INERTIE PROPORTIONNELLE AU CARRE DES VITESSES
CALCUL CENTRE INTERNATIONAL DES MAREES TERRESTRES /FAGS/ BRUXELLES

FACTEUR D ECHELLE 1.01197
TRAINAGE O1 0.48 M2 0.99 O1/M2 0.48
RETARD INSTRUMENTAL 12.98 MIN.
CORRECTION D ATTENUATION O1 1.00003 M2 1.00015 /MODELE 1/

LCR	402	76	6 23	76	7 17	76	7 20	76	7 26	76	7 30	76	7 30
LCR	402	76	8 4	76	8 14	76	8 18	76	9 1	76	9 6	76	9 6
LCR	402	76	9 10	76	9 10	76	9 14	76	9 22	76	9 27	76	9 27

NOMBRE TOTAL DE JOURS 80 1920 LECTURES

GROUPE	SYMBOLE	AMPLITUDE	PHASE EPOQUE CENTRALE	FACT.AMPL.	EQM	DEPHASAGE	EQM	AMPLITUDE MOYENNE
1- 62	Q1	3.6245	16.37	1.3012	0.1364	-17.21	6.03	4.1884
63- 88	O1	21.8000	131.66	1.1640	0.0232	-3.06	1.14	21.8225
89-110	M1	1.7262	112.05	1.0968	0.2617	-2.38	13.66	1.7774
111-143	P1S1K1	29.9418	198.59	1.0777	0.0145	-0.87	0.78	30.2894
144-165	J1	1.9534	344.75	1.5813	0.3274	18.65	11.86	2.0726
166-197	OO1	1.3935	145.92	2.1241	0.6594	-3.43	17.93	1.3622

ERREUR Q.M. D 11.669850

GROUPE	SYMBOLE	AMPLITUDE	PHASE EPOQUE CENTRALE	FACT.AMPL.	EQM	DEPHASAGE	EQM	AMPLITUDE MOYENNE
198-236	2N2	0.7943	252.22	1.1439	0.2642	-6.30	13.43	1.5901
237-260	N2	14.2706	74.06	1.2967	0.0370	-4.87	1.60	15.0919
261-286	M2	87.3559	172.98	1.3158	0.0062	-5.01	0.27	87.2711
287-300	L2	1.6399	80.47	1.4643	0.3235	-28.19	12.64	1.8926
301-347	S2K2	38.1308	140.22	1.2250	0.0135	-3.68	0.63	36.4003

ERREUR Q.M. SD 11.132982

O1/K1 1.0801 1-O1/1-K1 2.1115 M2/O1 1.1304

GROUPE	SYMBOLE	AMPLITUDE	PHASE EPOQUE CENTRALE	FACT.AMPL.	EQM	DEPHASAGE	EQM	AMPLITUDE MOYENNE
348-363	M3	1.2054	150.01	0.9774	0.0920	-7.88	5.25	1.2183

ERREUR Q.M. TD 2.993405
EPOQUE DE REFERENCE TJJ# 43000.0

TRANS WORLD TIDAL GRAVITY PROFILES ASIA - PACIFIC

	N	M2	N2	S2	K2	M2	N2	S2	K2		INST
HYDERABAD	180	1.1506	1.129	1.153	1.186	-0.36	-0.79	0.46	1.49	G	804
NEW DELHI	32	1.1546	1.178	1.157		-1.44	-3.29	-1.73		L	002
NEW DELHI	80	1.1901	1.182	1.213		0.32	-0.27	-0.82		G	804
KATHMANDU	80	1.1870	1.182	1.187		-0.27	-1.10	0.44		G	084
CHIANG MAI	132	1.1884	1.194	1.166		-0.32	-0.53	0.36		G	084
BANGKOK	96	1.1871	1.172	1.178		-0.32	0.20	-0.26		G	084
SAIGON	38	1.1565	1.110	1.158		-0.80	-3.52	0.24		L	002
PENANG	164	1.1293	1.125	1.133	1.137	-0.45	0.53	0.56	-0.02	G	765
HONG KONG	110	1.2746	1.222	1.289		-0.68	-1.76	-0.48		L	003
MANILA	86	1.1765	1.059	1.178		-1.77	1.59	-1.20		L	003
BAGUIO	42	1.2035	1.209	1.215		-2.14	-0.16	-1.46		L	002
BANDUNG	126	1.2508	1.236	1.211		-1.37	-1.04	3.59		L	336
WAKE	36	1.1705	1.172	1.218		1.18	-0.17	0.47		L	002
P.MORESBY	152	1.2319	1.267	1.279		-0.37	-2.89	0.90		L	003
CANBERRA	86	1.2097	1.217	1.196		-2.17	-1.97	-0.59		G	084
CANBERRA	78	1.2250	1.244	1.219		-2.17	-0.95	1.18		L	003
CANBERRA	96	1.2038	1.234	1.179		-2.17	-3.26	-1.00		L	008
CANBERRA	88	1.2057	1.203	1.191		-2.17	-3.71	-0.23		L	336
DARWIN	112	1.2044	1.186	1.243		0.95	-0.38	-1.28		L	336
CHARTERS TOW.	106	1.2368	1.265	1.256		-1.36	1.31	-1.11		L	003
ARMIDALE	160	1.1997	1.217	1.155	1.197	-2.39	-2.36	-1.11	0.62	G	084
ALICE SPRINGS	114	1.1730	1.155	1.166		-0.42	-0.60	1.19		G	084
BROKEN HILL	86	1.1587	1.235	1.187		-0.14	-0.61	-0.45		L	003
PERTH/MUND.	98	1.2375	1.224	1.222		0.40	1.02	-0.26		L	336
HOBART	130	1.2033	1.238	1.178		-4.14	-6.87	0.11		L	008
LAUDER	82	1.1723	1.239	1.107	1.203	-2.32	-2.49	-2.39		L	008
NOUMEA	80	1.3158	1.297	1.225		-5.01	-4.87	-3.68		L	402
MIZUSAWA	316	1.2211	1.220	1.243	1.250	1.25	1.73	0.48	-0.59	L	305
HELWAN/CAIRO	72	1.1701	1.300	1.123		-2.09	0.02	-3.15		L	336
BU CRAA	126	1.2109	1.156	1.096	1.224	1.34	0.49	-0.09	-2.47	A	212

	N	K1	P1	O1	Q1	K1	P1	O1	Q1		INST
HYDERABAD	180	1.1100	1.024	1.1531	1.038	-0.87	3.31	1.92	-0.97	G	804
NEW DELHI	32	1.1209		1.1524	1.168	-0.57		-0.61	-0.03	L	002
NEW DELHI	80	1.1969		1.1633	1.145	5.12		-0.10	1.39	G	804
KATHMANDU	80	1.1694		1.1743	1.163	0.29		0.62	4.78	G	084
CHIANG MAI	132	1.1041		1.1559	1.290	0.82		-2.12	-2.03	G	084
BANGKOK	96	1.1560		1.2192	1.274	-3.36		-1.39	-2.85	G	084
SAIGON	38	1.0487		1.1950	1.508	-8.64		-7.18	-6.86	L	002
PENANG	164	1.0501	1.133	1.1546	1.312	-7.44	-2.46	-9.71	-3.12	G	765
HONG KONG	110	1.2129		1.2737	1.287	-4.11		-4.86	-6.49	L	003
MANILA	86	1.1544		1.1582	1.051	-4.47		-7.40	-11.31	L	003
BAGUIO	42	1.1489		1.2139	1.322	-5.09		-7.40	-8.75	L	002
BANDUNG	126	1.1641		1.1669		8.54		9.50		L	336
WAKE	36	1.1856		1.2403	1.120	-2.55		-1.22	-4.85	L	002
P.MORESBY	152	0.9445		1.0690	1.030	7.45		-0.14	-7.41	L	003
CANBERRA	86	1.1641		1.1940	1.163	-0.39		-0.96	2.59	G	084
CANBERRA	78	1.1574		1.1940	1.309	-0.99		-0.96	3.40	L	003
CANBERRA	96	1.1511		1.1940	1.304	-1.63		-0.96	-2.35	L	008
CANBERRA	88	1.1545		1.1940	1.233	-0.57		-0.96	-2.40	L	336
DARWIN	112	1.2315		1.2730	1.323	-8.38		-1.59	3.09	L	336
CHARTERS TOW.	106	1.1329		1.1894	1.131	0.63		-1.21	0.31	L	003
ARMIDALE	160	1.1075	1.118	1.1585	1.189	-0.34	-0.29	-1.08	-1.15	G	084
ALICE SPRINGS	114	1.1510		1.1703	1.202	-0.46		1.51	2.98	G	084
BROKEN HILL	86	1.1307		1.1489	1.223	-0.41		-0.21	-1.27	L	003
PERTH/MUND.	98	1.2418		1.2413	1.292	2.32		2.54	3.63	L	336
HOBART	130	1.2102		1.2516	1.277	-2.94		-2.25	-2.71	L	008
LAUDER	82	1.1658		1.2339	1.257	-2.85		-2.10	-3.85	L	008
NOUMEA	80	1.0777		1.1640	1.301	-0.87		-3.06		L	402
MIZUSAWA	316	1.2236	1.213	1.2431	1.252	-0.09	-1.76	0.63	1.26	L	305
HELWAN/CAIRO	72	1.1448		1.1594	1.267	-1.59		-1.41	6.57	L	336
BU-CRAA	126	1.0912	1.182	1.2606	1.274	-7.22	-30.86	0.60	-4.32	A	212

Annex 4/3

TRANS WORLD TIDAL GRAVITY PROFILE ASIA

		G	N	A O1/K1	B 1-O1 1-K1	C M2/O1	O1
HYDERABAD	G	804	180	1.0388	1.3910	0.9978	1.92
NEW DELHI	G	804	80	0.9719	0.8293	1.0230	-0.10
NEW DELHI	L	2	32	1.0281	1.2608	1.0019	-0.61
KATHMANDU	G	84	80	1.0042	1.0287	1.0108	0.62
CHIANG MAI	G	84	132	1.0469	1.4975	1.0281	-2.12
BANGKOK	G	84	96	1.0547	1.4053	0.9737	-1.39
SAIGON	L	2	38	1.1395	4.0013	0.9678	-7.18
PENANG	G	765	164	1.0996	3.0867	0.9781	-9.71
MANILA	L	3	86	1.0033	1.0248	1.0158	-7.40
BAGUIO	L	2	42	1.0565	1.4363	0.9914	-7.40
HONG KONG	L	3	110	1.0501	1.2856	1.0007	-4.86
BANDUNG	L	336	126	1.0024	1.0170	1.0719	1 9.50
PORT MOR.	L	3	152	1.1319		1.1524	-0.14
CANBERRA	G	84	86	1.0257	1.1822	1.0131	-0.96
CANBERRA	L	3	78	1.0316	1.2325	1.0260	-0.96
CANBERRA	L	8	96	1.0373	1.2841	1.0082	-0.96
CANBERRA	G	336	88	1.0343	1.2562	1.0098	-0.96
DARWIN	L	336	112	0.9446	0.7909	0.9731	-0.47
CHART.TOW.	L	003	106	1.0499	1.4252	1.0398	-1.21
ARMIDALE	G	084	160	1.0460	1.4743	1.0356	-1.08
ALICE SPR.	G	084	114	1.0168	1.1278	1.0023	1.51
BROKEN HILL	L	003	86	1.0160	1.1388	1.0086	-0.21
PERTH/MUND	L	336	98	1.0337	1.1792	0.9461	-1.59
LAUDER	L	8	82	1.0584	1.4107	0.9501	-2.10
NOUMEA	L	402	80	1.0801	2.1112	1.1304	-3.06
MIZUSAWA	G	163	66	1.0279	1.1382	0.9592	1.12
MIZUSAWA	L	305	316	1.0160	1.0874	0.9823	0.63
WAKE	L	2	36	1.0461	1.2943	0.9437	-1.22
TEHERAN	A	119	1650	1.0073	1.0796	1.0450	0.43
HELWAN	L	336	72	1.0128	1.1013	1.0092	-1.41
BU-CRAA	A	212	126	1.1551	2.8554	0.9606	0.60

M3 COMPONENT IN TIDAL GRAVITY MEASUREMENTS

LAT	STATION	N	A	δ_3	E.Q.M.	α_3	E.Q.M.	INSTR
05 21	PENANG	164	1.67	1.0687	0.0177	-1.55	0.95	G 765
-06 54	BANDUNG	126	1.64	1.1039	0.0803	-7.07	4.25	L 336
-09 25	PORT MORESBY	146	1.54	1.0716	0.0351	0.13	1.95	L 003
-12 51	DARWIN	112	1.70	1.1814	0.1041	2.92	5.13	L 336
13 48	BANGKOK	96	1.50	1.1088	0.0694	3.77	3.61	G 084
14 38	MANILA	86	1.20	0.9304	0.0654	2.62	4.12	L 003
17 25	HYDERABAD	180	1.35	1.0074	0.0619	1.07	3.52	G 804
18 47	CHIANG MAI	132	1.47	1.1354	0.0412	1.61	2.10	G 084
-20 05	CHARTERS T.	106	1.36	1.0694	0.0799	-0.49	4.50	L 003
22 18	HONG KONG	110	1.21	1.0389	0.0782	-6.10	4.57	L 003
-22 19	NOUMEA	80	1.21	0.9774	0.0920	-7.88	5.25	L 402
-23 43	ALICE SP.	114	1.30	1.0554	0.0422	0.77	2.29	G 084
27 40	KATHMANDU	80	1.23	1.1173	0.0428	0.32	2.19	G 084
-30 35	ARMIDALE	160	1.03	1.0476	0.0372	-0.67	2.05	G 084
-31 59	PERTH	98	1.06	1.1119	0.0366	-0.39	1.89	L 336
-45 02	LAUDER	124	0.61	1.0761	0.1047	-7.81	5.69	G 008

LAT LATITUDE OF THE STATION
N NUMBER OF DAYS ANALYSED
A AMPLITUDE IN MICROGALS
INSTR INSTRUMENT - G - GEODYNAMICS L - LA COSTE ROMBERG